

## Are vascular disorders a common cause of erectile dysfunction in non hypogonadal, non neuropsychiatric patients?

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### Abstract

**Objectives:** Pharmacological Color Duplex Ultrasonography (PCDU) is a technique used as an advanced investigation of erectile dysfunction (ED) causes.

Aim of the study was to determine, if frequency of vascular disorders in ED patients justifies routine use of PCDU.

**Materials and Methods:** Seventy six patients aged 25-69 years with moderate to severe ED, free neuropsychiatric history and normal hormones were included in the study. The investigation consisted of basic ED work up and penile PCDU. Erection vascular parameters were determined.

**Results:** In the younger group ( $\leq 45$  years), 12% of patients demonstrated mild arterial insufficiency and none venous leakage, with only two patients not achieving hard erection. In the older group, 19.6% of patients demonstrated mild to moderate arterial insufficiency and 5.9% severe. Venous leakage was detected in 7.84%. Most patients (74.6%) achieved normal erection and 66.7% had normal PCDU parameters.

**Conclusions:** Vascular disorders were not found the primary cause of ED, especially among younger patients. PCDU is an advanced ED investigation, which should be applied only in vascular high risk cases. Hippokratia 2011; 15 (3): 244-246

**Key Words:** erectile dysfunction, color duplex, vascular disorders

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Erectile dysfunction (ED) is defined as a persistent inability (lasting for at least 6 months) to attain and maintain an erection sufficient to permit satisfactory sexual performance<sup>1</sup>. Normal erectile function requires normal anatomy of penis, unimpaired arterial supply and veno-occlusive mechanism, and intact autonomic and somatic penile nerve function<sup>2</sup>. Normal androgen level is also a necessary condition to retain sexual function<sup>3</sup>. Any disease, which affects one or more of the above parameters, could be a potential cause of. Psychological problems could be also a possible cause of ED, but are also typically a result of this condition, due to stress and fear of failure during intercourse. As a result, erectile dysfunction can be distinguished as a pure psychogenic and a mixed organic and psychogenic disorder<sup>4</sup>.

Defining the exact cause of ED in each individual is not often easy and necessary. Basic ED work up usually consists of full medical, sexual and psychological history and basic laboratory investigation including hormonal profile. Pharmacological Color Duplex Ultrasonography (PCDU)<sup>5</sup> may be needed in some cases where vascular disorders during erection are suspected.

Relation of endothelial and erectile dysfunction is well established and this may reflect a generalised vascular disease<sup>6</sup>. Metabolic syndrome is certainly a common risk factor for ED and vascular disease and penile Duplex vascular parameters are usually affected in these

patients<sup>7</sup>. However, frequency of vascular abnormalities in PCDU investigation in ED patients of a routine andrology clinic is not known. If these abnormalities are frequent, it would be of benefit to perform routinely PCDU in all patients, who at least do not present with an obvious non vascular cause of ED.

The aim of this study was to assess the frequency of vascular disorders detected through Color Duplex investigation after penile injection of vasoactive agent in two age groups of patients without any obvious reasons for non vasculogenic moderate to severe long lasting ED and so to determine, if this investigation is justified to be used routinely or not.

### Materials and methods

The present study has been approved from the scientific and Ethics Committee of "G.Gennimatas" General Hospital of Thessaloniki, Greece and all persons gave their informed consent prior to their inclusion in the study. We also certify that there is no actual or potential conflict of interest in relation to this article.

Seventy six patients aged 25-69 years old with moderate to severe ED underwent PCDU investigation after a basic ED work up from June 2007 to October 2008. Severity of ED had been determined by Sexual Health Inventory for Men (SHIM) questionnaire. Patients with score below 10 had severe ED and with score 11-17 had

moderate ED. Patients were divided into two groups according to their age. Group A consisted of 25 patients aged 25-45 years old, and Group B of 51 patients aged 45-69 years old.

Exclusion criteria comprised major pelvic surgery, presence of neurological disease, treatment with psychiatric medication, or diagnosis of hypogonadism or other hormonal dysfunction. All patients had suffered from ED for more than two years.

The ED investigation included a full medical history, physical examination and a full laboratory and hormonal investigation. Reasons for pursuing PCDU investigation included failure of oral phosphodiesterase (PDE) 5 inhibitors, planning for surgery, and more often, patient request.

After 15 minutes of intracavernosal injection (ICI) of 20 µg of prostaglandin E1 (alprostadil) and redosing in case of failure to have an erection, all patients underwent Color Duplex Ultrasonography to measure the diameter of the cavernosal arteries, the arterial maximum systolic velocity (PSV), the end diastolic velocity (EDV) and the resistance index (RI). Corpora cavernosal diameters were measured also before and after ICI.

Comparison of the results was carried out using the Mann-Whitney U test. All data analysis was conducted using the SPSS v. 13.0 statistical analysis software. Differences were considered statistically significant at  $p < 0.05$ .

## Results

In Group A, penile anatomy appeared normal on the ultrasound scans in patients. The mean total corpora cavernosum diameter was 23.7 mm in the flaccid state and 35.9 mm in full erection, demonstrating a 12.63 mm average increase. Most patients (92%) achieved full erection after 15 minutes of ICI.

Group A mean measures were as follows: mean PSV,  $35.05 \pm 5.39$  cm/s; mean EDV,  $4.27 \pm 0.85$  cm/s; and mean RI,  $0.87 \pm 0.03$ . The mean diameter of the right cavernous artery was  $1.52 \pm 0.27$  mm and the left was  $1.63 \pm 0.36$  mm.

In Group B, four patients suffered from diabetes (7.8%), three patients from coronary heart disease (5.8%) and five patients (9.8%) from Peyronie's disease. Laboratory and hormonal investigations were normal in general.

The mean total corpora cavernosum diameter was 23.89 mm in the flaccid state and 32.87 mm in full erection demonstrating an average increase of 8.98 mm. Thirteen patients (25.4%) achieved only a moderate erection after 15 minutes of ICI.

Group B mean measures were as follows: mean PSV  $32.11 \pm 4.39$  cm/s; mean EDV,  $4.59 \pm 0.92$  cm/s; and mean RI,  $0.85 \pm 0.04$ . The mean diameter of the right cavernous artery was  $1.69 \pm 0.39$  mm and the left was  $1.56 \pm 0.39$  mm. Ten patients (19.6%) presented with mild arterial insufficiency, three (5.9%) with moderate to severe arterial insufficiency, and four patients (7.84%) presented with impaired veno-occlusive mechanism.

Except for one case of priapism in a 28 year-old patient, who was treated conservatively, no other major

**Table 1:** Comparison of the mean vascular parameters values in the two groups

RESULTS	Group A	Group B	p-value
PSV	$35.05 \pm 5.39$	$32.11 \pm 4.39$	0.020
EDV	$4.27 \pm 0.85$	$4.59 \pm 0.92$	0.154
R.I.	$0.87 \pm 0.03$	$0.85 \pm 0.04$	0.001
Right artery	$1.52 \pm 0.27$	$1.69 \pm 0.39$	0.134
Left artery	$1.63 \pm 0.36$	$1.56 \pm 0.39$	0.510

complications appeared.

Comparing the vascular parameters of the two groups of patients, there were statistically significant differences between PSV and RI values ( $p = 0.020$  and  $0.001$ , respectively). Table 1 summarizes the mean values of the vascular parameters in the two groups.

## Discussion

Basic work up for moderate and severe ED is not usually enough for diagnosis of the cause. However, despite the fact that the vast majority of these patients will be treated with medication, injections or implants for the refractory cases independently of ED cause, many patients, especially younger, request further investigation of their condition. PCDU is an objective, relatively easy to perform and low cost method for the diagnosis of vascular disorders of erection<sup>8</sup>.

Generally, indications for PCDU include primary ED, failure of PDE 5 medication without obvious reason, abnormal rigiscan test, abnormal intracavernosal injection test, planning for penile implant and patient's request. Aversa and colleagues recommend all ED patients with a significant risk of cardiovascular disease, as well as in the presence of penile plaques suggesting the involvement of neuro-anatomical structures, should undergo PCDU<sup>9</sup>.

The normal values for the evaluative parameters are  $PSV > 30$  cm/sec,  $EDV < 5$  cm/sec<sup>10</sup> and  $RI > 0.80$ <sup>11</sup>. Peak systolic velocity and a change in cavernous artery diameter are indicators of arterial inflow, while the pathological end diastolic velocity and resistance index signify venoocclusive dysfunction<sup>12</sup>.

Various parameters of PCDU, such as the diameter of the cavernosal artery, peak systolic flow velocity, the degree of arterial dilatation and acceleration time, have been suggested for the diagnosis of arteriogenic ED, but peak systolic flow velocity is the most accurate indicator of arterial disease<sup>8</sup>. The value of the peak systolic velocity (PSV) describes arterial inflow and has a waveform corresponding to increasing intracorporeal pressure and rigidity of the penis. Patients with a normal maximal PSV and complete erectile response evaluated in the beginning of tumescence are considered normal<sup>12</sup>. Patients with low maximum PSV and incomplete erectile response are likely to have arterial insufficiency, but the veno-occlusive function cannot be isolated by study of the hemodynamic parameters<sup>12</sup>. Patients with a low maximal PSV but com-

plete erectile response probably have an arterial insufficiency compensated by a good veno-occlusive function. This must be interpreted carefully because lower PSV may be seen in subjects with a full erectile response, if valid arterial communications are present<sup>13</sup>.

Currently, the venogenic ED resistance index (RI) is usually an accepted parameter for evaluating venous competence depending on the end diastolic velocity (EDV). Patients with normal maximum PSV but an incomplete erectile response are considered to have a veno-occlusive dysfunction in association with a resistance index less than 0.8. The main limitation of PCDU is its lack of specificity for venous leakage in the presence of arterial insufficiency. Moreover, a continuous arterial inflow in case of a decreased response to PGE1 can be accompanied by a continued flow in diastole, which results in the diagnosis of a false-positive venous insufficiency<sup>14</sup>. Finally, incomplete smooth muscle relaxation, due to exaggerated patient's stress could prevent demonstrating normal veno-occlusive function even, if maximum dose of vasodilator has been injected.

The conclusion coming up from the above is that PCDU is a minimally invasive investigative tool for diagnosis of vasculogenic ED with several limitations. If the PCDU result is normal, the vascular investigation is generally complete. However, when it is abnormal, cavernosography, cavernosometry and arteriography should be performed for patients who are considered potential candidates for surgical therapy, particularly for revascularization surgery<sup>15</sup>.

In the present study, where ED patients with obvious non vascular causes were excluded, appeared that vascular disorders were not the main cause of ED. Only 12% of the younger group of patients demonstrated a mild vascular disorder, and only two patients (8%) did not achieve hard erection after ICI. It is more interesting that the older ED group presented with only small increase in the frequency of vascular disorders. In this group, 33.4% of patients demonstrated vascular dysfunction and only 25.4% did not achieve hard erection after ICI.

A question arising from these results is what the reason for ED would be among these patients. In Group A, patients were younger with a no history of disease, therefore organic ED was not likely. The main reason of ED in unselected young patients visiting an outpatient andrology clinic is psychogenic. This is usually supported by their sexual and social background, by their quick response to PDE 5 inhibitors and by the fact that they usually don't need to continue treatment for more than three months, especially if they have permanent sexual partners.

In Group B patients, abnormal PCDU were more frequent. However, the majority of these patients demonstrated normal PCDU and achieved normal erection after ICI, indicating normal function or well compensate mild vascular disease. Probably their problem is multifactorial, a mixed organic and psychogenic disorder<sup>4</sup> where vascular disorders are not the most frequent finding.

The conclusion of the present study is that normal

PCDU, which precludes normal penile vascular function, was the most frequent finding in both age groups, where obvious non vascular ED causes were excluded. As a result, PCDU should not be used as a routine investigative method in all age ED patients, even if obvious non vascular ED causes are excluded. Patients should be explained for that and understand that advanced ED investigation should be applied with scepticism only in special cases to save cost, time, potential complications and avoid more psychological burden.

On behalf of all authors there no conflict of interest on this article

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